The very elderly in intensive care: admission characteristics and mortality

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ABSTRACT

Objective: It is often assumed that critical care outcomes in the elderly are uniformly poorer than those in younger populations. We examined the pattern of admissions to our intensive care unit in Dublin, Ireland, between 2002 and 2005 to determine the admission characteristics and mortality in those aged 80 years and older.

Methods: Data were collected retrospectively from a local audit database and patient charts.

Results: The very elderly represented 5.1% of ICU admissions over the period with an ICU mortality of 15.4%. Age-adjusted APACHE II scores were similar to those in the younger group (median, 7 for both groups). The average length of ICU stay (±SD) was similar in the very elderly and younger groups (4.03 ± 0.51 v 4.86 ± 0.31 days; $P = 0.52$), as were readmission rates (5.7% v 5.2%). Age was not predictive of ICU mortality. The most important determinants of ICU mortality were emergency (versus elective) admission, non-operative (versus postoperative) source of admission and higher age-adjusted APACHE II score.

Conclusions: The nature of the admission and severity of illness, but not age, are determinants of ICU survival. Evidence-based criteria are needed to assess the appropriateness of ICU admission in the very elderly. Clear criteria would help to prevent initiation of futile therapies and also to ensure that the very elderly are not denied potentially beneficial ICU care. We need to study triage patterns and outcome data further to ensure that the very elderly have the same opportunities to access appropriate intensive care treatment as the rest of the population.

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The percentage of the population aged over 65 years is increasing in most developed countries. For example, in Ireland, this percentage is expected to rise from 11.1% in 2002 to 13.4% by 2015 (Central Statistics Office, Dublin, Ireland). Figures in Australia are similar, with the percentage of people older than 65 years likely to rise from 12.4% in 2001 to 15.5% in 2015.[1] Very elderly patients (defined by the SUPPORT[2] group as those aged 80 years and older) are being admitted to intensive care units in increasing numbers, and have relatively good survival rates compared with the average life expectancy of an 80-year-old (7.2 years for men and 8.7 years for women in the United Kingdom in 2002[3]). There is an apparent tendency for physicians to overestimate the importance of age in survival and to underestimate the quality of life for elderly survivors.[4] Yet, triage decisions regarding admission to the ICU frequently use age as a determinant.[5]

We examined the pattern of admissions to the ICU at our hospital to determine both the nature of admissions and the mortality in patients aged over 80 years.

Methods

The critical care service at Mater Misericordiae Hospital, Dublin, Ireland, encompasses two areas — an 18-bed ICU and a nine-bed high-dependency unit (HDU) — which treat both medical and surgical patients. We undertook a retrospective review of admissions to the ICU over the 4 years, 2002–2005, to identify patients who were aged 80 years or older on the day of ICU admission. Information on the nature of the admission (elective, emergency or readmission) was obtained from a local database that records all admissions to the ICU. Readmission was defined as a patient requiring admission to the ICU after having been discharged to the general ward; it excluded readmission from the HDU, which is part of the critical care area in our institution. APACHE II[6] (Acute Physiology and Chronic Health Evaluation) scores on admission were also recorded. Length of stay in the ICU, and ICU, 30-day and hospital mortality were noted.

Statistical analysis

APACHE II scores were compared both with, and without, the age component included. Results are expressed as mean (SD) if data were normally distributed and, if not, as median (range). Unpaired Student's *t* tests or Mann–Whitney tests were performed, using GraphPad Prism version 4.00 for Windows (GraphPad Software, San Diego, Calif, USA) as appropriate for data sets. Multiple logistic regression was used to determine which factors independently increased the odds ratio of mortality in the ICU.

Table 1. Admissions to the intensive care unit, 2002–2005, by patient age*

	18–79 years	80 + years	*P*
No. of patients	4067	208	
No. of admissions	4521 (94.8%)	245 (5.2%)	
APACHE II score			
Median	11	14	< 0.001
Age-adjusted median	7	7	0.84
Length of stay (days): mean (SD)	4.86 (0.31)	4.03 (0.51)	0.52
Readmission rate	231 (5.2%)	14 (5.7%)	0.88
Emergency admissions	1763 (39%)	133 (54%)	
Elective admissions	2758 (61%)	112 (46%)	
ICU mortality	465 (11.4%)	32 (15.4%)	0.08

APACHE II = Acute Physiology and Chronic Health Evaluation score.[6]
* Figures represent number of admissions (% of total) unless otherwise indicated.

Results

Patients aged 80 years or older represented 5.1% of ICU admissions over the 4-year period examined (245 out of 4777). They accounted for 11.4% of all hospital admissions in this time (6922 out of a total of 60 531 admissions). The mean age in this group at admission was 82.7 (SD, 2.56) years. The group comprised 208 patients, who had a total of 245 separate admission episodes. Three had admissions at different times over the study period. Fourteen were readmitted from the ward, and 20 were transferred from the HDU to the ICU.

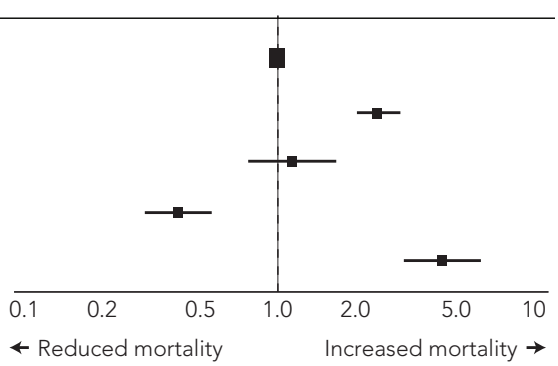
The ICU mortality for the very elderly group was 15.4% (32/208) (Table 1). This compares with an ICU mortality rate of 11.4% (465 out of 4067 patients) in those aged less than 80 years. The difference in mortality was not statistically significant ($P = 0.08$). The 30-day mortality for those aged over 80 years was 27%, and the in-hospital mortality was 36%. The ICU mortality for very elderly patients undergoing emergency surgery was 21% (nine out of 42 patients) and for emergency medical admissions was 28% (19 out of 68 patients). There was one death each year after elective surgery, giving a mortality of 4% (four out of 98 patients). This had the effect of lowering the overall mortality rate in the very elderly group to 15.4%. However, elective patients accounted for a smaller percentage in the 80 years and over age group (46%) than among younger patients (61%). There were more surgical than medical admissions in the very elderly group because of patients who required intensive care after elective surgery (a mixture of cardiac, vascular, major general and orthopaedic surgery). Emergency cases formed the majority of admissions (54%) while 46% were elective admissions.

Median APACHE II score in the very elderly group ($n = 245$) was 14 (range, 3–41) compared with 11 (range, 3–42) in those aged less than 80 years ($n = 4521$). The difference was statistically significant ($P < 0.001$). When the APACHE II score was adjusted for age, the median score was 7 in both groups ($P = 0.84$). The median age-adjusted APACHE II score for all survivors, regardless of age group, was 8, and for non-survivors was 13.

Mean length of ICU stay for the very elderly was 4.03 days (SD, 0.51 days) compared with 4.86 days (SD, 0.31 days) in those aged less than 80 years. The difference was not statistically significant ($P = 0.52$). The readmission rate to the ICU after discharge from the critical care area was 5.2% in those less than 80 years of age and 5.7% in the very elderly group. The difference was not significant ($P = 0.88$). In the group aged less than 80 years, the readmission rate was significantly higher among the 465 who subsequently died than among those who survived (11.2% v

Figure 1. Forest plot showing odds ratio of ICU mortality associated with each independent variable

Variable	Odds ratio	Limits Lower	Limits Upper	*P*
Length of stay	1.00	0.99	1.01	1.00
APACHE II score > 8	2.47	1.97	3.09	< 0.001
Age	1.14	0.75	1.73	0.54
Postoperative source*	0.4	0.29	0.55	< 0.001
Emergency admission†	4.42	3.06	6.39	< 0.001



* Postoperative versus non-operative source.
† Emergency versus elective admission.

4.4%; $P = 0.02$). In the very elderly group, the readmission rate was higher among the 32 who subsequently died than among those who survived (9.4% v 5.2%), but the difference was not statistically significant ($P = 0.69$).

Using data for all ICU patients during the study period, multiple logistic regression analysis showed that age and length of stay were not predictive of mortality in the ICU (Figure 1). Patients admitted to the ICU postoperatively had a lower risk of death than the non-operative group (odds ratio [OR], 0.4; 95% CI, 0.29–0.55). Emergency admissions had a much greater risk of death in the ICU than elective admissions (OR, 4.42; 95% CI, 3.06–6.39). Each unit increase in age-adjusted APACHE II score was associated with an increased risk of mortality of 1.07 (95% CI, 1.05–1.08). The odds ratio of mortality at an APACHE II score > 8 (compared with all scores < 8) was 2.47 (1.97–3.09) (Figure 1), and at a score > 13 (compared with all scores < 13) was 2.70 (95% CI, 2.15–3.38).

Discussion

Triage decisions regarding admission to the ICU frequently use age as a determinant.[5] Ely et al noted that, at their institution, 12 of 30 intensivists felt that age influenced their decision to admit older patients to the ICU, 16 felt it influenced their decision to intubate, and 28 felt it influenced them in relation to "do not resuscitate" orders.[7]

We found that age alone was not predictive of death in the ICU. There was a trend towards increased mortality in the very elderly group that was not statistically significant. The major determinants of ICU mortality during the 4-year study period were the source and nature of admission. Patients whose admission was an emergency had a much higher risk of subsequent mortality than those whose admission was elective. Those who were admitted after surgery (which was largely elective) had a lower risk of mortality than non-operative admissions. Higher age-adjusted APACHE II scores were associated with increased ICU mortality.

The very elderly in our group formed a small percentage (5.1%) of all admissions to the ICU over the 4 years. While the numbers of the very elderly admitted to European ICUs are relatively small, they have been increasing in line with demographic changes, with greater life expectancy and increasing numbers of very elderly people presenting for ICU admission.[8] In 1997, Castillo-Lorente and colleagues found that 12.5% of patients in 86 ICUs in Spain were over 75 years of age.[9] The overall hospital admission rate was nearly double the ICU admission rate for the very elderly. Although we did not examine patterns of referral to the ICU or number of patients refused ICU admission, these figures suggest that very elderly people presenting for ICU admission were screened before admission to determine the benefit of ICU care. Only one study has looked specifically at triage decisions in the very elderly (over 80 years of age): Garrouste-Orgeas et al found that, of 180 patients referred for ICU care, 132 were refused.[10] Factors associated with refusal included non-surgical status, age older than 85 years, and a full unit.

The ICU mortality in our group of very elderly patients compared favourably with the mortality in those aged less than 80 years. While there was a slightly higher mortality among the very elderly, it did not approach that shown by Nicolas et al[11] or Cohen and Lambrinos.[12] Nicolas et al analysed the influence of age on ICU survival from data collected on 792 admissions to eight ICUs in France in 1987. They reported that ICU mortality increased progressively with age: for patients aged over 65 years, it was more than double that for patients aged under 45 years (36.8% v 14.8%).[11] Cohen and Lambrinos found in-hospital mortality rates of 70% for patients aged over 85 years who received mechanical ventilation compared with 32% for patients aged 29 years or younger.[12] However, when mortality data were adjusted for severity of illness by Ely et al in a study of mechanical ventilation in a group of patients aged over 75 years, no survival difference was noted in comparison with younger patients.[7] Our group of very elderly patients were likely to represent a cohort with fewer comorbidities and greater physiological reserve than those not admitted to the ICU. The vast majority of deaths in the very elderly were in those admitted as emergencies compared with those admitted after elective procedures. There is probably an inherent selection bias in the latter group, as they have already passed through screening for surgery and anaesthesia before presenting for ICU admission, and they are likely to represent a cohort of physiologically fitter patients.

Thirty-day and in-hospital mortality in our study compared well with mortality observed by Boumendil et al in Paris.[13] In a 2-year prospective study of patients aged over 80 years admitted to a medical ICU, they found an ICU mortality rate of 19.5%. The long-term mortality rates for those patients were 41% at 2 months, 67% at 2 years, and 71% at 3 years.

We found that the mean length of ICU stay of the very elderly was only slightly less than the average for patients younger than 80 years of age admitted to the ICU ($P = 0.52$). This is in keeping with findings from other studies.[8] It has also been shown that even when length of stay is similar, the very elderly do not receive as intense treatment as those who are younger.[8] In our group of selected very elderly patients, it can be inferred from their shorter length of stay that the associated costs of care did not exceed those in the younger group, and indeed are likely to have been less.

Patients younger than 80 years who died during intensive care had a significantly higher rate of readmission than the group who survived. This was expected. While there was a greater percentage of re-admissions among non-survivors in the very elderly group, this difference was not statistically significant. This may be explained by the small numbers of readmissions (three) and deaths (32) in this group, which did not provide sufficient statistical power to show a difference. It is also possible that there is more reluctance to readmit the very elderly to intensive care after discharge to the ward.

Somme at al, in a study of 410 intensive care patients older than 75 years, found that APACHE II score (and not chronological age) was the only independent predictor of ICU mortality.[3] Our study confirmed that age-adjusted APACHE II score is an independent predictor of ICU mortality in all age groups.

Our study was conducted in a single centre and was retrospective. Our results may not be applicable to institutions with a different casemix and different percentage of very elderly admissions. In the CUB-REA database, which covers 36 hospitals in Paris, France, the proportion of very elderly patients admitted to an ICU ranged from less than 3% in a cancer-specialised ICU to more than 20% in a general ICU in a rural area.[8] Mortality rates in the very elderly would have been higher, with a greater proportion of medical and emergency admissions. While it can be inferred that our very elderly cohort underwent a process of pre-selection (there was no difference in age-adjusted median APACHE II scores between the very elderly and those aged less than 80 years), we do not have a set of objective criteria that were used for decision-making. The lack of such evidence-based criteria as a basis for triage decisions is a universal problem.[8]

There is a broad consensus in the literature that chronological age may be associated with higher rates of in-hospital mortality, but that it is not the principal cause. ICU mortality is much more closely predicted by a combination of the severity of the presenting illness and impairments in functional status before admission.[7,14] However, mortality at 2 years after ICU admission is predicted by age and also by pre-existing limitations on care. The mortality prediction model of Inouye et al[15] may help define limitations in elderly patients. This model assesses patients for evidence of impairment — physical (impairment in activities of daily living = 1 point), cognitive (Mini Mental State Examination score < 20 = 1 point) and psychological (Geriatric Depression Score > 7 = 1 point).[15] In their cohort of patients aged over 70 years, a score of zero was associated with a 2-year mortality rate of 24.5%, a score of 1 with a mortality rate of 45%, and a score $\geqslant 2$, with a mortality rate of 60%.

Conclusions

Age alone is not a determinant of ICU mortality in patients who have been admitted to the ICU. Of more importance are the nature and source of admission and severity of the presenting illness; patients with emergency non-operative admissions and higher APACHE II scores fared worst in terms of survival. Those very elderly patients who survive ICU are unlikely to have protracted lengths of stay. As the proportion of the very elderly in the population increases, the benefit of intensive care treatment in this group will come under closer scrutiny. There have already been calls to make "age-based" medical discrimination illegal.[16] Evidence-based criteria are needed to determine the appropriateness of ICU admission in the very elderly. Clear criteria would help to prevent initiation of futile therapies and also to ensure that the very elderly are not denied potentially beneficial ICU care. We need to study triage patterns and outcome data further to ensure that the very elderly have the same opportunities for access to appropriate intensive care treatment as the rest of the population.

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